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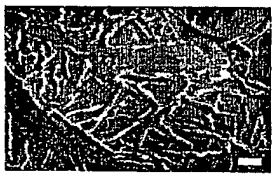
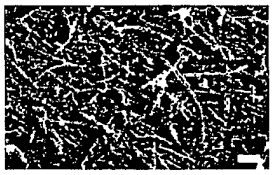
[Continued on next page]

(54) Title: NANOFIBERS AS A NEURAL BIOMATERIAL

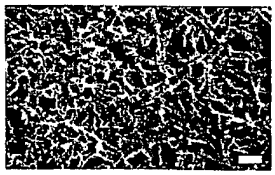
(a) 100:0 (PU:CN wt. %)



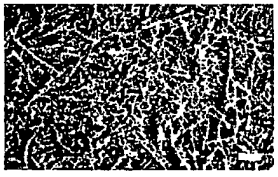
(b) 98:2 (PU:CN wt. %)



(c) 90:10 (PU:CN wt. %)



(d) 75:25 (PU:CN wt. %)



(e) 0:100 (PU:CN wt. %)

(57) Abstract: Nanomaterials for neural and orthopedic prostheses are disclosed. Composite carbon nanofibers enhance neuronal growth and minimize glial scar tissue formation. Methods and compositions to promote neuronal growth and minimize scar tissue formation during prolonged monitoring and treatment of neural tissue are disclosed. Composite polyurethane carbon nanofiber is a suitable material for neural implant. Composite carbon nanomaterials decrease adhesion of astrocytes and fibroblasts.

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Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

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— *with amended claims*

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

AMENDED CLAIMS

[received by the International Bureau on 28 March 2005 (28.03.2005); claim 3 has been cancelled; original claims 1and 2 have been replaced by amended claims 1 and 2; original claims 4-18 and 20-22 were renumbered as 3-17 and 19-21 ; original claim 19 amended and renumbered as claim 18. (2 pages)]

[C1] A neural implant comprising a device coated with a carbon nanofiber material.

[C2] A neural implant comprising a device, wherein at least one component of the device is made of a carbon nanofiber material.

[C3] The neural implant of claim 3, wherein the carbon nanofibers are about 2 to 200 nm in width.

[C4] The neural implant of claim 4, wherein the carbon nanofibers comprise carbon nanotubes.

[C5] The neural implant of claim 5, wherein the carbon nanotubes are functionalized.

[C6] The neural implant of claim 5, wherein the carbon nanotubes are aligned.

[C7] The neural implant of claim 1, wherein the implant is a neural probe.

[C8] The neural implant of claim 2, wherein the nanomaterial comprises a matrix selected from the group consisting of polyurethane, polymethacrylate, polyester, polyvinyl and any copolymers thereof.

[C9] The neural implant of claim 2, wherein the implant is a neural probe.

[C10] A neural prostheses comprising an implantable device with a composite polyurethane carbon nanotube, the device capable of stimulating neuronal growth and minimizing glial scar tissue formation.

[C11] The neural prostheses of claim 11, wherein the carbon nanotube comprises 2% to 100% of the composite.

[C12] The neural prostheses of claim 11, wherein the carbon nanotube forms a carbon nanofiber.

[C13] The neural prostheses of claim 13, wherein the carbon nanofiber is about 100 nm.

[C14] Use of a neural implant that minimizes scar formation comprising:

(a) obtaining a neural implantable device;

(b) coating the implantable device with a nanomaterial; and

(c) securing the implantable device in the neural tissue.

[C15] Use of a neural implant that minimizes scar formation comprising:

(a) obtaining a neural implantable device comprising a nanomaterial; and

(b) securing the implantable device in the neural tissue.

[C16] A method of stimulating neuronal growth and minimizing scar formation by an implant in a brain, the method comprising:

(a) obtaining a neural implantable device comprising a nanomaterial;

(b) securing the implantable device in the brain; and

(c) providing neuronal stimulants through the device.

[C17] An orthopedic prostheses comprising an implantable device coated with a composite polyurethane carbon nanotube, the device capable of stimulating osteoblast proliferation and minimizing fibroblast encapsulation.

[C18] A method of stimulating osteoblast proliferation and minimizing fibroblast encapsulation by an orthopedic implant, the method comprising:

(a) obtaining an orthopedic implantable device comprising a carbon nanofiber material; and

(b) securing the implantable device.

[C19] A method of selecting a nanomaterial suitable for implant, the method comprising:

(a) determining structural dimensions of a biological molecule in a biological tissue; and

(b) fabricating the nanomaterial whose surface structural dimension is similar to the biological molecule.

[C20] A method of claim 20, wherein the nanomaterial comprises carbon nanofibers of about 2-200 nm in width.

[C21] A method of claim 20, wherein the biological molecule is laminin.